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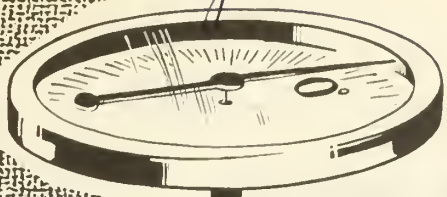
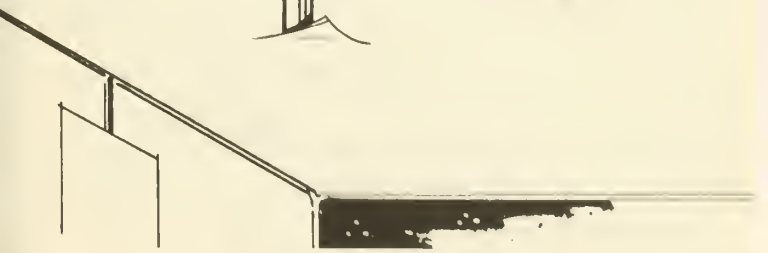


# Research for Better Quality in Frozen Foods





Agricultural Research Service
U. S. DEPARTMENT OF AGRICULTURE

# FACTS FROM RESEARCH

## on preservation of fine quality in frozen foods under various time and temperature conditions

**For all commercial handlers** of frozen foods—from packers to retailers—one of the most important facts is that **quality loss moves faster and faster as temperature rises!**

Rates of increase in loss differ. Discoloration appears in some fruits and vegetables more quickly than in others. Losses of flavor and vitamin C also vary in rate. Original quality, processing, and packaging can cause differences. **But all kinds of quality loss move increasingly faster as temperature reaches higher levels.**

Another important fact is that **temperature damage is not visible or tastable in its early stages!** Held for only a day at 20°F., for example, a product is not likely to show evidence of damage, particularly if it has been well protected. But changes that ultimately result in visible and tastable damage have begun. Others less easily detectable, such as loss of vitamin content, have also developed.

Still another important fact is that damage accumulates. **It never disappears!** Lowering to 0°F. protects against further loss. But reduction to 0° or any lower temperature does not correct mistreatment.

Much damage can occur—and does—in **hard-frozen products that are above 0°F.** Even at temperatures as high as 25° many products still feel hard. But here losses of fine quality proceed at a very rapid rate.

Rates of loss continue to increase as foods reach defrosting and higher temperatures. Although foods vary in ability to withstand defrosting, in most cases quality loss is severe, even with fast refreezing in blast freezers.

**Frozen fruits.**

Frozen peaches are quickly and conspicuously damaged. Brown slices can cause consumer complaint and may become apparent after total exposures of a day or two at 30°F., 2 weeks at 20°, 2 to 3 months at 10°, or 2 years or longer at 0°F.

Strawberries undergo flavor changes that become easily detectable within 1 to 2 days at 30°F., 6 to 12 days at 20°, or about 3 months at 10°F. Flavor change is early evidence of quality loss. Discoloration and loss of vitamin C also occur under these conditions.

Frozen raspberries reveal temperature damage less quickly but tend to lose color from berries to sirup at fairly rapid rates. This change definitely indicates that the product is losing its fresh condition.

**Frozen concentrated orange juice.**

The tendency of concentrated frozen orange juice to separate into two layers after water is added for serving is the first evidence of temperature damage. This kind of quality loss is highly sensitive to rising temperature. One or two trips up to defrosting and down are sufficient to do irreparable damage. Longer periods at 20° or still longer periods at 10° will cause similar damage. Loss of a stable cloud in the juice, jelling in the can, and eventually loss of flavor, are sometimes serious hazards.

**Frozen vegetables.**

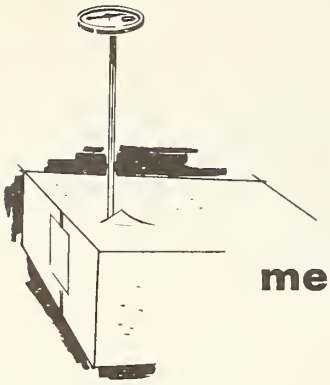
From carefully processed frozen green beans, chlorophyll (green pigment) is lost at the rate of about 10% per year at 0°F., which is not severe. At 10°, however, this rate triples. At 20° it is 16 times and at 30° it is 60 times as fast as at 0°F. Peas lose color somewhat more slowly than beans. In both of these vegetables undesirable flavors develop more slowly than changes in color. All losses, however, are increased by rising temperature.

**Frozen poultry.**

Loss of moisture, rancidification, and darkening are kinds of loss of quality that occur in frozen ready-to-cook poultry. Rate of deterioration approximately doubles for each 10 degrees (F.) of rise in temperature. Turkeys are less stable than chickens and cut-up poultry is less stable than whole birds. For average commercial frozen poultry products, 0°F. maintains quality for a year or longer and provides a margin of safety for the consumer.

**Prepared frozen foods.**

Loss of "freshly cooked" flavor is the first change detected in cooked poultry meat. Later staleness and rancidity are detectable. Sauces and gravies offer some protection to prepared poultry dinners, pies, and creamed products. Frozen fried chicken, which is very sensitive to temperature, undergoes a change in flavor within 4 to 6 months at 0°F.



## Protective measures

Take temperatures!

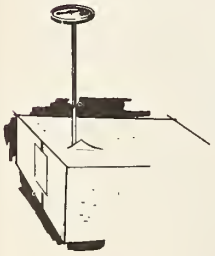
Throughout the frozen-food industries, better quality for consumers means constant attention to temperatures. Frequent measurement of temperature of products and of refrigerated space enables one to become "temperature minded." He learns the performance of equipment and how to handle it. He knows whether or not good quality is getting the protection it needs. Here's very important advice: **Don't rely on the squeeze test. The squeeze test tells only whether or not a package is defrosted. A hard package may be 20 or 25 degrees above 0 F.**

Observe quality!

Everyone who handles or uses frozen foods should become familiar with good quality —with original colors, excellent flavors, and attractive textures and general appearance. Ability to judge quality without use of technical analyses is very helpful. In cases of special need, accurate physical and chemical tests can be used (see below).

Objective tests.

The test for vitamin C (ascorbic acid) is not very complicated and can be carried out by anyone with sufficient laboratory experience. The original content of ascorbic acid can be determined by measurement of the products of its chemical breakdown. A test for chlorophyll and its conversion to pheophytin is similarly practical. Measuring the extent to which the red color of raspberries has moved into the sirup is an indicator of temperature experience. If sugar concentration in berries is the same as in the sirup, previous thawing is indicated.



**The most protective measure is:**

**Keep temperatures low!**

## About the research project

The project on Time-Temperature Tolerance of Frozen Foods has been conducted over several years by the U. S. Department of Agriculture in Albany and Pasadena, Calif. The research objective has been to develop comprehensive information on the effects of temperature hazards on color, flavor, vitamin content and other quality factors of frozen foods.

The immediate purpose is to provide frozen food industries—packers, transporters, warehousemen, distributors, and retailers—with facts for use in establishing corrective measures.

The overall purpose is assistance to a rapidly growing system of food processing nad distribution which has large potential capacity for preservation of high quality of agricultural products.

For more detailed information write to Western Regional Research Laboratory, Albany 10, California—headquarters of the Western Utilization Research and Development Division, Agricultural Research Service, U. S. Department of Agriculture.

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